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ABSTRACT

This is the tenth module in the series "Expanded Programs of Consumer Education" and is suggested for use either as a discrete unit or with other units in the series. In Part I, technology and its effects are defined and explained, with automation and computers briefly considered. The topics of pollution, recycling, energy sources, and the energy crisis are dealt with. For each topic in this guide, desired student understandings are specified, pupil and teacher learning activities are suggested, and sources of information are cited. (DT)

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Coping with The Problems of a Technological Age

Part I

one of a series for expanded programs in CONSUMER EDUCATION

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The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Bureau of Secondary Curriculum Development
Albany, New York 12224
1973

COPING WITH THE PROBLEMS OF A TECHNOLOGICAL AGE

Part I

One of a series in Expanded Programs of Consumer Education

The University of the State of New York/The State Education Department
Bureau of Secondary Curriculum Development/Albany/1973

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FOREWORD

In 1967, the State Education Department published "Consumer Education — Materials for an Elective Course." This material has since been introduced into more than 500 of the New York State high schools. As a result of the interest in Consumer Education in the State and Nation, the Department has begun the preparation of a series of modules — Expanded Programs of Consumer Education. This module, Coping With the Problems of a Technological Age, is the 10th to be produced. Those already distributed are:

Consumer Issues and Action
Education and the Consumer
The Consumer and Recreation
Consumer Problems of the Poor
The Consumer and His Health Dollar
Beauty Products and the Consumer
The Consumer and Transportation
Taxes and the Consumer
Law and the Consumer
Credit and the Consumer.

It is expected that another module will be produced in the field of The Car and the Consumer.

Nothing touches the lives of the disadvantaged more than the constant struggle to stretch limited financial resources to meet the increasing costs of living. This module is designed in the hope that it will help the poor to make better use of their income, as well as with the expectation that those of higher income will be more understanding of the problems of their fellow citizens.

Unlike the original syllabus, where 12 units covering various phases of Consumer Education were bound together, the modules in Expanded Programs of Consumer Education are being prepared as separate publications to provide greater flexibility. Each of the 10 modules in the series may be used as a discrete unit or with other units in the series. The 10 modules may be presented as a semester or part of a semester course, or presented in conjunction with the original syllabus which covers such areas as the purchase of food; shelter; appliances; automobiles; and a consideration of credit; money management; fraud, quackery, and deception; banking and savings; life and health insurance; security programs; and consumer law.

It is hoped that the presentation of the modules as separate publications will tend toward flexibility in their use as mini-courses in such fields as social studies, business education, home economics, industrial arts, agriculture, and other areas of the curriculum.

The suggestions to the teacher found in "Consumer Education — Materials for an Elective Course," pages 1-4, apply equally to each of these modules. The reaction and suggestions of those using these materials in the field will be helpful to the Department in planning further materials for Consumer Education and in making necessary revisions of the material.

The material for this module was developed and written by Hillis K. Idleman, associate in secondary curriculum development.

Appreciation is expressed to Commissioner Henry L. Diamond, New York State Department of Environmental Conservation and to members of his staff for the cooperative review of this material and for the invaluable suggestions offered.

Gordon E. Van Hooft
Director, Division of
Curriculum Development

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INTRODUCTION

The industrial process has had many benefits for mankind in lessening the amount of brutal physical work that makes people old before their time, in increasing the comfort and convenenience of living, in making it possible for relatively few farmers to feed a large part of the world, and in improving sanitation, health, education, transportation, and virtually every aspect of life.

Yet even the greatest of boons is seldom unaccompanied by offsetting penalties. So it has been with each step of man's technological advances. Chief among the prices we are paying for technology is pollution -- of our air, our land, and our waters. Nor is pollution a new problem. Even at the height of the Roman Empire, Rome had little public sanitation. During the Middle Ages "home sanitation consisted of throwing everything out of the windows — everything. The few latrines that existed were often close to water wells, and streets were lined with garbage-filled gutters. It is little wonder that the tragic Black Death epidemics of the 14th century carried off an estimated one-to three-fourths of the population of Europe."

"Pollution worries go back to the Romans (who complained that charcoal smoke soiled their togas), but they are a very real part of our world today. As we work to clean up our air and water, we are already far from our ancestors of only a hundred years ago, who died by thousands of typhoid and various plagues — and never even knew why. Our air, even in cities, is improving — a 75 percent reduction in sulfur emissions alone in New York City over the last decade."*

Since technology plays such a big role in our lives it seems appropriate that consumers develop a background of understanding which will help them to make intelligent decisions in the marketplace, and support their elected representatives in legislative halls to make wise laws as far as the environment is concerned. Most effective to all will be economic power as reflected by the choice of products they buy (or do not buy), their adherence to good ecological practices, and their influence upon industry through their votes as stockholders.

It is reasonable to believe that much of the accomplishment in cleaning up the air, the waters, and the land has been due to the clamor of an enlightened citizenry. The kind of environment we will have in the future will largely depend upon public attitudes and actions.

Further, the kinds of products and the service requirements of those products will be greatly affected by the response of consumers. Industry is responsive to expressions of approval or disapproval, and even more responsive to sales figures. If consumers are really troubled about products that consume inordinate amounts of energy or which are costly to maintain, a rejection of these products will speedily affect change.

But despite the most sincere and dedicated efforts of both consumers and industry, it will be necessary for government to play a strong role in quality control, the handling of waste products, and their disposal. It has been suggested that industries should be made to reveal the components of any product and the suggested method of disposal.

*"Pollution: A Problem That Isn't New," Petroleum Today, 1972/two American Petroleum Industry, 1801 K Street, N. W., Washington, D. C. 20006.

Coping with the products of a technological age becomes more and more difficult each year as new products and new technological processes appear. It is easy for consumers to become bewildered by conflicting scientific and pseudo-scientific claims. Even regulatory authorities are often in conflict, to say nothing of the views of industry spokesmen who may have personal motives. An example of conflicting claims of regulatory bodies occurred recently in the Albany area where State Health authorities seized quantities of canned goods on the claim that the lead seams posed a potential lead poisoning hazard. Within a few days the United States Food and Drug Administration announced that no hazard existed. When authorities cannot agree, consumers are indeed at a loss.

This module attempts to describe the kinds of problems that technology poses for the consumer. It suggests some attitudes and actions to help the consumer bring about such corrective action as he supports. The effects of technology, the energy crisis, the supply of natural resources, the problems of repair costs, the matter of wise consumer choice, and the effects of a changing technology on all aspects of life are considered.

In the long run, most of the decisions regarding this problem come down to a matter of choice. As the editorial* in the Wall Street Journal of May 18, 1973 put it:

> How Badly Do You Want Clean Air? by Burt Schorr
>
> WASHINGTON—Sooner than they realize, Americans may have to choose between the automobiles they love and the clean air they say they want.
> The 1970 Clean Air Act is beginning to pose fundamental questions about the nation's economic and psychological dependence on the automobile.
> In essence, the act sets strict air pollution standards for metropolitan areas as a whole, and urban planners already are finding that the only way to meet them will be to drastically limit the number of cars on the streets.
> The committee report on the original Senate bill, which passed without opposition, stated that "as much as 75% of the traffic may have to be restricted in certain large metropolitan areas" during the 1975-85 decade when low-emission vehicles generally are replacing uncontrolled and partially controlled older models.
> What is involved in ... greater urban areas, from the standpoint of air pollution, is the whole complex of residential patterns, the employment patterns and transportation patterns—the way in which people move about, go to their work and live—all of this ... must be modified if the objective of clean air is to be achieved."
> The law will test whether the public "really wants clean air." If it does it has to give up something—it might

*excerpts only are reproduced

be dollars, it might be comfort, but something. And that, in the largest sense, is what pollution control ultimately means.

The same principle – that every advance in safety or pollution control of land, water, and sound has a price tag – applies to other areas of consumer use of technologically produced materials. It all boils down to "how badly consumers want" clean air, and water, and earth, and safe products. Through our choice of legislative representatives, through our power in the market place, through our vote as stockholders of the Nation's industries, we can buy a safe environment and safe products – but only at a price in dollars, in convenience, and possibly even in relations with other Nations.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT IS TECHNOLOGY?		
. Technology is the science of the mechanical and industrial arts; applied science, engineering: the application of scientific knowledge to practical purposes in a particular field.	. Ask students for their understanding of technology. Do they see technology as applied science? Do they view it as a helpful or harmful development? Do they mention the social changes brought about by technology? . Ask students to report on striking examples of science fiction involving technology which they have read. . Ask pupils who have jobs to report on the uses of technology in their places of employment. . Look for evidences of applied technology in the school. Are records and reports processed by machines? Are their evidences of technological advances in the multi-media center? in the school business office?	. Linzberg, Eli, "Technology and Social Change," Columbia University Press, New York. . "A source of great authority over nature, the modern scientific technology promises to be both the hope of man's future and the instrument of his enslavement or destruction. If we are to avoid the disasters it lays open to us and take advantage of the opportunities it presents we ... must understand what modern technology is, what it means, and what must be done with it if it is to serve man well." Stover, Carl F., "Technology and Culture"
WHAT ARE SOME OF THE EFFECTS OF TECHNOLOGY?		
. The effects of technology are found in every aspect of life, from medicine, to education, to employment, to entertainment and space travel.	. Students who show an interest might volunteer or be assigned to - trace the historical development of technology - inquire into the causes of change - research the social problems that have accompanied this change	. "For millions of Americans, personal finance is moving rapidly beyond easy pencil-and-paper calculations. To ease this task for people here, Seattle-First National Bank has begun a service that lets subscribers keep track of household budgets and important records simply by
	(Con.)	(Con.)

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	- relate the effects of automation upon the nature of work, work relationships, skill levels, consumption patterns, and the operation of the free, competitive market. . Ask science students or the science teacher to discuss the nature of some of the more dramatic technological changes. . Have parent or other employed persons discuss how technology has affected their lives. . Watch TV programs discussing the discontent of laborers on the assembly line. What solutions do students propose to this problem?	telephoning a computer from home. "The system, called 'In-Touch,' actually converts the push-button telephone into a computer terminal—an idea long discussed but until recently considered too expensive for widespread use. In-Touch gives subscribers 100 minutes of access to a talking computer, enough time for 200 average entries, for $6.50 a month. Every two weeks they receive mailed printouts summarizing budget activity by categories." "This Computer Pays Your Bills," The National Observer, June 18, 1973
WHAT IS AUTOMATION?		
. Automation is control of a process or mechanism by automatic rather than human means, especially by electronic devices and servomechanisms. It is one of the products of technology.	. Gather information and pictorial displays of evidences of automation in our lives. Consider the effects on trains, planes, flight controls, office operations, household appliances (toasters, washers, dryers, coffee makers, electric blankets, frying pans), light control, automobile parts (transmissions, ignition), factories, libraries, and the vast vending machine business.	. Automation is a method or technique of making a manufacturing process, a production line, or a machine operate automatically by the use of built-in or supplementary controls.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT IS A COMPUTER?		
. A computer is a mechanical, electrical, or electronic device for solving complex problems.	. Ask pupils for evidences of transactions involving a computer. Most common evidences are punch cards (data cards with holes punched in particular positions for automatic sorting, selecting, arranging, or computing in automatic machines).	. "Computers the size of a matchbox can do the work of a packing case full of normal electronic equipment," Newsweek.
. A computer is "programed" by a data-processor who writes in computer language a series of steps to perform a particular operation.		. A new type of criminal specializes in theft by computer. Although such thefts are directed against business rather than the individual consumer, the consumer still pays in the long run.
. These operations are recorded by the computer on "print-outs," which are detailed diagrams of a computer's activities.	. What are commonly found examples of such punch cards? (telephone or utility bills, toll records, automobile license or registration cards).	. Types of theft include: - embezzlement - destruction of information - theft of trade secrets - falsification of records
	. What are the advantages of the use of such cards?	
	. What are the possible disadvantages?	. "Frauds involving billions of dollars have companies searching for new ways to thwart a spreading danger," U.S. News and World Report, June 18, 1973.
HOW CAN COMPUTERS ADD TO CONSUMERS' PROBLEMS?		
. Once a computer is programed, it continues to function in the same fashion regardless of the special problems of an individual account.	. Collect and write up experiences of consumers dealing with companies using computers: - Were special requests ignored? - Was there ever duplicate billing of accounts already paid? - Were there examples of excessive credit costs?	

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
HOW HAS TECHNOLOGY AFFECTED HOME LIVING?		
. Most of the tasks that made the homemakers' life of an earlier age one of drudgery are now done by machine.	. Invite older people in the community, particularly housewives, to describe what homemaking was like before the advent of modern machines. Some may remember when water was pumped by hand and carried into the home, when coal and wood were the source of fuel for the stove, when clothing was washed by hand, when there were no vacuum cleaners and the dust mop and carpet sweeper were the best cleaning tools.	. "Data Banks — Privacy or Accuracy?" Canadian Consumer, April 1973
. Food preservation and preparation were time consuming chores. . Today "convenience" foods are readily available, but at an extra cost.	. Although some housewives may still preserve food by canning, freezing, or drying, increasingly these tasks are done by industry. With the help of the home economics teacher, investigate the comparative costs of preparing vs. buying already prepared goods.	. "In 1950, Americans ate little processed poultry. But since then such foods have expanded at an average rate of nearly 15 percent a year. Our use of processed poultry has risen from barely a pound per person in 1955 to upward of six pounds. In the early 1950's, frozen meat dinners and pies, many featuring chicken and turkey, made their debut. Since then, chicken dinners have cornered more than a third of the retail market for frozen dinners; and turkey and gravy combinations, another fourth. Of meat pies, about two-thirds contain chicken

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		and turkey. Other major processed poultry products include roasts and rolls, pre-fried or breaded poultry, and parts, soups, stews, and baby foods." "Focus on Food Markets," Cooperative Extension, Cornell University, New York State.
WHY IS IT IMPORTANT THAT THE CONSUMER LEARN HOW TO COPE WITH THE PROBLEMS OF A TECHNOLOGICAL AGE?		
. All of us are consumers of air, water, food, clothing, appliances, furnishings, and services from birth to death. . Ultimately, either in direct or indirect ways, the consumer pays for all that he consumes. . When space was unlimited, man was not too concerned with pollution of air, water, and land. If pollution became a problem, he simply moved on to a new and less polluted spot. . As populations increase, and the attractions of populated areas increase, man finds it impossible or impractical to move into fresh environments. Increasingly he finds himself choked by his own wastes.	. Discuss the understanding of pupils as regards the problems of consumers. On a chalkboard or bulletin board list the problems they are aware of. Among them might be these: - inflation - service - rising housing costs - costs of health care - food costs - the right to get one's money's worth If the discussion does not lead into the problems of pollution, raise such questions as these: - Is the consumer affected by the cost of controlling air pollution? If so, how? Does the cost of a car reflect more stringent standards of emission control? - Is the consumer affected in his tax	. See other modules in the Expanded Programs for Consumer Education, Bureau of Secondary Curriculum Development, State Education Department, Albany, N.Y. 12224 . "The New York City Department of Air Resources estimates that 1,304 million tons of carbon monoxide, lead, hydrocarbons, and other irritating gases and dusts were emitted in New York City in 1969 alone," New York Daily News, March 9, 1970 . "Scientists know that smog can kill. In 1966, 168 people died as the result of a smog formation during the Thanksgiving period." Ibid. . "Annoyance, anxiety, constrained and explosive rage, disturbed sleep, irritability, and energy-draining

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
. Ultimately, man must find a way to cope with the products of a technological age or he will perish.	bill by the costs of purifying the waters? If so, how? - Does the cost of an airplane ticket reflect the increased costs of noise pollution by aircraft? - How is the consumer affected by the shortage of adequate recreational spots? Who pays to clean up existing eye-sores and to purchase new recreational lands?	tensions" may result when noise levels are too high. New York Times, March 12, 1970. . "Isn't It Time We Learned?" Environmental Task Force, State Education Department, Albany, New York 12224. . "The Consumer and Recreation," Bureau of Secondary Curriculum Development, State Education Department, Albany, New York 12224.
. As man struggles to cope with his environmental problems, largely caused by technology, he finds that most of his consumer needs cost more -- and will cost even more in the years to come.	- Why do spark plugs, mufflers, and automobile valves corrode so much faster than they used to? Is this a consumer problem? - Is excessive noise destroying our hearing? Is this a consumer problem? - Does the management of solid wastes -- junk, beer cans, bottles, old cars, appliances -- pose a problem to the consumer? - Is the problem of sufficient pure drinking water a consumer problem? What conclusions can the class draw regarding environmental quality and its effect on the consumer?	. U. S. Bureau of Outdoor Recreation, Washington, D.C. . The Federal Consumer Protection and Environmental Health Service has been set up to remind us that: "The human environment consists not only of land, air, and water that give us life, but also includes the food we eat, the drugs we ingest, and all the thousands of products which we consume or use in this complicated world." Time, March 16, 1970.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
IS THERE A PLAN TO HELP NEW YORK STATE ACHIEVE A BETTER BALANCE SO THAT THE BENEFITS OF TECHNOLOGY CAN BE ACHIEVED WITHOUT DESTROYING THE ENVIRONMENT?		
. Yes, many agencies have made proposals of what must be done to achieve an ecological balance. The most recent and one of the most detailed plans is the proposal of the New York State Department of Environmental Conservation, entitled "Environmental Plan for New York State - Preliminary Edition."	. Secure a copy of the Environmental Plan for New York State. Note that it is devoted to five major areas of land, water, air, fish and wildlife, and energy. . Set up committees of students to review the major recommendations of the report in each of the five areas. . Invite discussion and debate on the proposal. Consider the opinions of land developers, conservationists, homeowners, recreational groups, and industry. Summarize the views of the class on these proposals and forward them to the Department of Environmental Conservation for reaction. Specifically, how do pupils react to the proposals regarding - population distribution; - regional rather than local planning; - land usage; - cluster type developments; - revamping of the property tax toward a regional or best use assessment;	. New York State Department of Environmental Conservation, 50 Wolf Road, Albany, 12201 . "Throughout history, environmental forces have influenced the rise and fall of man's civilizations. The invention of agriculture harnessed a great force of nature to feed men reliably. The sea became the first universal medium for large-scale transport of goods (and conquest). Flood, fire and volcanic action destroyed cities. Slow decline or disaster occurred when man exhausted his land, stripped his forests and fouled his cramped cities." "Environmental Plan for New York State - Preliminary Edition," New York State Department of Environmental Conservation, 50 Wolf Road, Albany, 12201 . "To get environmental progress, we have also to recognize and resolve contradictions between environmental good and what are, in point of fact, harmful luxuries: lavish use

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	- adjustment of the capital gains advantage for those who now sell land; - implementation of the Adirondack private land plan; - limiting use of recreational vehicles to specific areas; - control of litter, junk, and signs; - establishing package standards and product design for manufacturers to follow?	of electric power; heedless and redundant packaging; over-large, overpowered cars; all-consuming highway systems and parking lots. A suitable balance of interests--as the need for amenities and human scale in urban renewal projects versus the economics of high-rise building--is complex and is not always easy to achieve. Conflicts of parties at interest--such as truckers and taxi operators who supply essential services to the central city, as against the resident and working population whose health is endangered by pervasive exhaust gases--pose other real difficulties, human as well as economic." Ibid.
		. "While there must be major social and economic adjustments to resolve today's environmental problems, ever new adjustments will be needed to keep pace with change due to man's ever-expanding knowledge. Our alarm about environmental degradation has raised serious doubts about the consequences of all technological progress.... It will be crucial in the future to introduce technological change with the greatest caution in order to avoid unexpected new problems." Ibid.

Smog Covers New York City

Photo courtesy New York State Environmental Conservation Department

Pond with oil wastes and oil drums

Land fill - soil and garbage 100 feet thick

Photos courtesy of New York State Environmental Conservation Department

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHY SHOULD THE POOR BE CONCERNED WITH THE PROBLEMS OF A TECHNOLOGICAL AGE?		
. The poor pay more, in terms of the share of their disposable income available for goods and services, than do those in higher economic brackets.	. Discuss the consumer problems of the poor. Draw from the class a list of ways in which the poor, particularly, suffer from the effects of technology.	. "Consumer Problems of the Poor," Bureau of Secondary Curriculum Development, State Education Department, Albany, N. Y. 12224
. Often the poor, because of lack of transportation, poor shopping practices, lack of competition, or exploitation, pay more for the same goods and services than do more privileged consumers.	. What class of people ordinarily have the unskilled jobs in coalmining, sweeping, cleaning, and in other industrial jobs where laborers are exposed to the hazards of noise, dirt, and air pollution?	. "Consumer Problems of the Poor," Bureau of Secondary Curriculum Development, State Education Department, Albany, N. Y. 12224
. The poor are often less able to secure satisfaction for their grievances.	. What group is most exposed to the fumes from traffic in the inner city? - As industry passes on its costs of cleaning the air, the water, and the soil, what group can least afford the increased costs of everything they buy?	. "The Consumer and Transportation," Bureau of Secondary Curriculum Development, State Education Department, Albany, N. Y. 12224 . "Environmental Education Instructional Activities," Publications Distribution Unit, State Education Department, Albany, N.Y. 12224
. Applications of technology have eliminated many of the unskilled jobs formerly held by the poor.	. Consider the types of jobs eliminated by the newer applications of technology. What has happened to the "pick and shovel" laborer? What types of machinery now perform tasks formerly done by hand? . Consider planting, hay baling, barn cleaning, etc., formerly done by hand on a farm. How are ditches now dug for septic tanks, telephone and electric cables,	

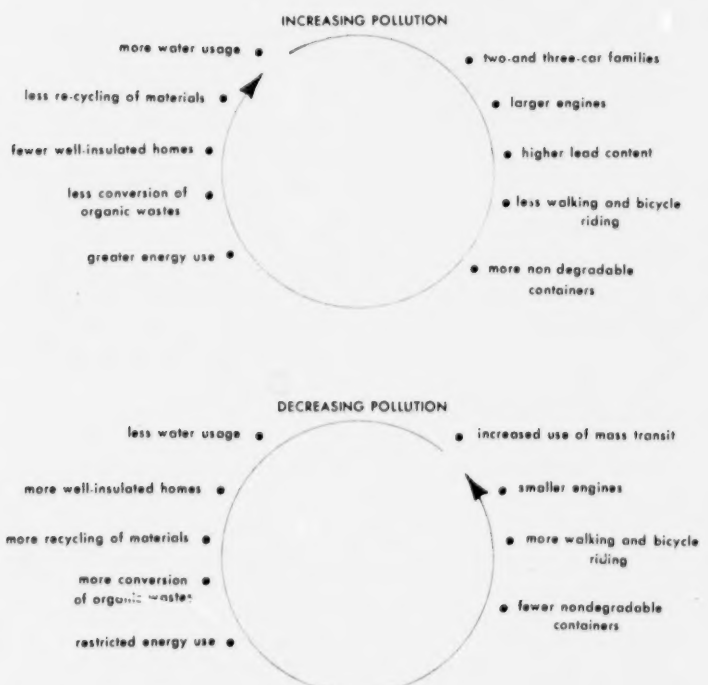
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	and other underground installations? What has happened to the "hand laundry"?	
	. To what extent has the machine, which performs multiple jobs of precision drilling, welding, soldering, joining, etc., replaced hand labor?	
. However, technology has created many new jobs.	. Consider new jobs created by technology, many of them open to the poor with little technical training. Poll industrial employment sources to learn of new jobs requiring little skill in such lines as automobile, radio, TV, and sound systems. What new jobs are open in the field of assembly of such items as small appliances, vending machines, etc.? To what extent has industry tended to have these assembly jobs performed in foreign lands where labor costs are lower than in the United States?	
HOW HAS TECHNOLOGY AFFECTED OUR LAND AND OUR WATERS?		
. The "gross" effects of an industrialized society are readily apparent to even the most untrained observer, though he may not necessarily recognize them as such or even make the connection. They may be seen in - the contamination of rivers, lakes, oceans; - in the cutting of our forests; - in diminished and crowded areas for recreation;	. Have pupils survey waterways in their community. Is there evidence of pollution? Has fish life diminished? Is there evidence of deforestation? Are recreational spots limited and overcrowded?	. Freeman, W. H., "Resources and Man," National Academy of Sciences/National Research Council. See chapter "Food from the Sea," 1969. . Berrill, N. J., "The Life of the Ocean," McGraw-Hill, 1966.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
- in reports of contaminated fish and other marine products; - in reports of food poisoning from the use of sprays and preservatives; - in diminished supplies of certain types of sea food.	. Have pupils watch for articles or TV programs dealing with food contamination or the possible hazards of sprays or chemical additives. Prepare a bulletin board display of newspaper or magazine articles dealing with these subjects.	. Bringham, Robert, "Crisis at Sea: The Threat of No More Fish," Life, December 3, 1971. . "Environmental Education for Resource People," U.S. Forest Service Department of Agriculture, Washington, D.C. 20250, attention Information and Education Division.
. The more insidious effects may be noted in societal values, the effects on organisms (psychological, physiological), and the interpersonal and intergroup relationships.	. Invite an environmental engineer or a sanitary engineer to speak to the class on problems of pollution. What does his agency do in this area? What can citizens do to help?	"Man Builds-Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224, pp. 73-78.
WHAT SHOULD BE THE ATTITUDE OF CITIZENS TOWARD THE EXPANDING USE OF AUTOMOBILES?		
	. Ask pupils to re-examine their attitudes regarding the automobile. Are automobiles efficient "people movers" in an urban situation? Are high powered cars desirable? Are two and three cars in a family really necessary? Do we buy cars as a status symbol? . Should citizens support mass transit as an alternative to the use of automobiles? Should citizens support bond issues for mass transit?	. "The auto system is an extremely inefficient way to move people in an urban area. The auto uses 10 to 50 times as much land as the train. A maximum of 3,000 auto passengers an hour can move over a 12-foot-wide highway lane whereas 60,000 riders an hour can be transported by train over a similar land strip. A train moves its carload of passengers at one-tenth the expenditure of energy per passenger of an automobile."

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Have pupils list ways in which pollution from cars could be diminished: -use of lower powered engines -use of nonleaded gas -use of mass transit facilities -use of car pools -use bicycles or walk -fewer cars per family -reduce speed limits -restrict auto use in certain areas and during thermal inversions -improve personal driving skills and habits -remove auto air conditioners and automatic transmissions, power windows, etc.	. "Unquestionably, an increase in public mass transit facilities and riders is a key to improving the urban environment. Yet, with each subway and bus fare increase, the number of passengers declines, leading to a loss of revenues...which is met by another fare increase, perpetuating the downward spiral in passengers. This is accompanied by deterioration of service, fewer trains or busses at off hours, and an increase in the use of private vehicles. Every city person should be aware of this cycle and understand that the spiral must be broken." "Man Builds—Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224.
	. The majority of people are not willing to make the necessary sacrifices. Will new laws be the most effective solution? How else can habits and preferences of people be changed?	. Leavitt, Helen, "Superhighways — Superhoax," Doubleday.
	. What other problems has the automobile posed? Has the change in the way of life of the average American as a result of car ownership been a unmixed blessing? What has been the effect on the environment of the construction of a network of superhighways? Has the convenience of car ownership been worth the cost of dead and injured in automobile accidents?	. Buel, Ronald A., "Dead End: The Automobile in Mass Transportation," Prentice-Hall, 1972. . "Planners Worried by Suburban Auto Glut," New York Times, January 3, 1972.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT CAN BE DONE ABOUT THE WASTE PROBLEM?		
. As technological skills have improved, man tends to produce materials at a faster pace than they are broken down by nature. . Before industry produced goods at so prodigous a pace, most products were decomposed at about the same rate as they were produced. - elements were recirculated through living things and back through air, water, or earth in what are called biochemical cycles.	. What are some of the waste products produced by the American family? (garbage, cans, paper products, old cars, discarded tools, etc.) How might the amount of waste be curtailed? To what use could these products be put? How do other countries handle the problem of waste products? (In many European countries shoppers bring a shopping bag to market. No boxes or paper bags are provided).	. "Organic waste conversion to oil could help supply energy needs while alleviating urban refuse problems. "Developed by the Interior Department's Bureau of Mines, the process converts organic wastes--garbage, trash, animal manure--into non-polluting synthetic low-sulfur oil. The oil produced, in turn, is potentially suitable for use by power plants or for conversion to gasoline and diesel-type fuels. "One oil company recently demonstrated a successful experimental waste-oil conversion process, and results of a pilot-plant operation indicated that approximately one barrel of low-sulfur fuel oil can be produced economically from one ton of municipal solid waste. "While this concept seems appealing on environmental grounds, it can have only a minor impact on our energy situation. Even if all municipal waste were converted at this ratio, it would supply our petroleum needs for less than two weeks.

THE CONSUMER COPES WITH THE PROBLEMS OF A TECHNOLOGICAL AGE



UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Investigate what has happened in San Diego county as a result of the Environmental Protection grant.	"Organic waste conversion has yet to prove its economic and technical feasibility on a commercial scale. No prototype has yet been authorized, and much more research is needed. "Synthetic fuel from coal, as discussed earlier, is still another possibility. "In fact, more research is needed in the entire synthetic fuel area. In certain instances, the resources do indeed exist in large quantities. Future technology may provide answers to problems of extraction on a commercially acceptable basis. But, for the rest of this decade, synthetic fuels as major energy sources can appear only as intriguing possibilities." Roberts, Meredith, "Synthetic Fuels," Petroleum Today, 1972/two, American Petroleum Industry, 1801 K. Street, N. W., Washington, D. C. 20006.
. Man has created both huge quantities of material, and materials of synthetic nature which are not easily decomposed by nature. The result has been that natural systems have become overloaded. Trash, sewage, smog, and garbage are examples of production of materials at a faster rate than nature can dispose of them.	. Have pupils give evidence of how products may be recirculated back through living things, or by air, water, or earth. . How adequately is your community handling the problem of wastes?	
. Other materials, synthetic in nature, such as plastics and some detergents, are not biodegradable and thus can exist for a long time.	. Comment on the statement of Environmental Commissioner Henry Diamond of New York, "What must be done is to get as close to the closed system as possible." In order to get near a closed system, where almost everything is used again, what new processes and changed patterns of living would be necessary?	. "The Urban Refuse Research Center near College Park, Maryland, experiments with processing incinerator residues. Its research has shown that from 80 to 85 percent of the material can be reclaimed. Using conventional methods, the plant screens iron, steel, and nonferrous metals. Its researchers have made new, usable glass from

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. The New York State Environmental Quality Bond Act will assist communities unable to bear alone the costs of constructing refuse disposal plants. Some communities are making solid plans to construct such plants. Check with the Department of Environmental Conservation for recent developments.	waste, unusable glass; have made brick from 70 percent waste glass and 30 percent clay; and have shown that the operation can be run profitably. A number of cities have shown an interest, but the huge capital costs involved have blocked construction of such a working plant." "Man Builds—Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224
	. What could individual families do in the recycling area? (make compost out of garbage, flatten cans for recycling, cut down on the use of shopping bags, collect and recycle newspapers, support efforts to have merchants pay a refund for returned bottles, etc.).	. "In a nation and age of affluence, the old adage about 'waste not, want not' seems to have been turned topsy turvy. Yet the national waste disposal bill is $4.5 billion for municipal costs alone, a tariff of billions more is levied by=air pollution, and some resources like copper already are in short supply. It is almost certainly true that the old adage holds, but we have simple not toted up the whole bill." "Man Builds—Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT EFFORTS ARE NEEDED TO CHANGE LAWS AT THE FEDERAL LEVEL TO INCREASE RESOURCE RECOVERY AND RECYCLING?	. Sponsor an assembly at which ecologists can describe the problem and suggest ways in which individuals can help solve it. . How successful have recycling attempts been? What are the problems of recycling paper, cans, bottles, tires, old cars? . Write to the following agencies to see what you can do to help the environment. . Environmental Action, Room 731, 1346 Connecticut Ave., N.W., Washington, D.C. 20036. . Friends of the Earth, 529 Commercial St., San Francisco, Cal. 94111. . Izaak Walton League of America, 1800 N. Kent St., Suite 806, Arlington,Va. 22209. . National Audubon Society, 950 Third Ave., New York, N.Y. 10022. . National Wildlife Federation, 1412 Sixteenth St., N.W., Washington, D.C. 20036. . Sierra Club, 1050 Mills Tower, 220 Bush St., San Francisco, Cal. 94104. . The Conservation Foundation, 1717 Massachusetts Ave., N.W., Washington, D.C. 20036	. "User's Guide to the Protection of the Environment," Friends of the Earth/Ballantine . Ask the county agricultural agent for information about starting a compost bed. . Hannon, Bruce, M., "Bottles, Cans, Energy," Environment, March 1973. . Cole, Lamont, C., "What to Do With Waste? Use It Over and Over and Over Again," New York Times Magazine, April 2, 1972. . "What Can You Do To Clean Up the Environment? Plenty!" Changing Times, Kiplinger Magazine, March 1972

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT ARE THE FACTORS WHICH HAMPER RECYCLING?		
. Reused materials save vital resources. But there are problems in using them.	. The amount of recycled material is increasing steadily, but there are problems of cost and of impaired quality which restrict this process.	. Rubber from discarded tires is now mixed with hot asphalt and used to surface highways. . More than 40 percent of the metal in copper, lead, and stainless steel products is recycled material.
. Labor costs are high	. Have pupils who have participated in "clean up" drives relate their experiences as to the amount of labor involved in picking up trash, and in separating it into kinds. If labor were paid the going rate, would it be profitable to pick up beer cans and bottles or to separate paper according to its type?	. Bottle makers now use up to 50 percent of recycled glass in their wares vs. 10 to 30 percent a few years ago.
. Prices paid for salvaged materials are low.	. Find out what junkmen are paying per pound or per ton for paper, iron, lead, and copper.	. Even plastic is being recycled in small amounts for dumbbells, wine racks, and containers.
. The quality of recycled materials is often lower than the original product.	. What are the problems with reusing paper and rubber?	"The quality of a recycled commodity is often a problem. While some, such as copper are as good as the original, many others are inferior to virgin materials. When paper is reclaimed, the cellulose fibers become shorter, which can affect the product's strength. Thus, used papers are often recycled into lower-grade uses; stationery, for example, is sometimes recycled into carboard boxes. Sometimes inks and glues

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE

The nation may be looking to Baltimore's projected Landgard solid-waste system for some better answers to a monumental question:

WHY WASTE WASTE?

BALTIMORE, MD.

A FOUR-YEAR-LONG, broad-based commitment for a cleaner Baltimore has caught hold with impressive results that are complementing the city's changing skyline and holding out a bright promise for a better urban environment.

Most dramatic of the improvements is the modernized, imposing Metro Center, where gleaming new towers and more under construction symbolize a revitalized city.

But a great deal of less glamorous groundwork also shares importance, such as the most recent major effort launched early this year when Mayor William Donald Schaefer broke ground for the city's new $15 million non-polluting *Landgard* solid-waste disposal and resource-recovery system.

This first full-scale installation of *Landgard*—an advanced engineering development of Monsanto Enviro-Chem Systems, Inc.—will process 1,000 tons a day of municipal waste and simultaneously produce salable steam energy and other useful by-products. It is being funded by a $6 million grant from the federal Environmental Protection Agency (EPA), $4 million from the Maryland Environmental Service, and the remainder from the city treasury.

The Baltimore *Landgard* system is one of six demonstration projects being financed in part by EPA to help determine the best and most feasible way for cities to get out from under the growing burdens of trash they generate.

The awesome dimensions of this problem nationally have been calculated in Washington by the EPA personnel involved in planning the recycling program in Baltimore and the other demonstration cities.

Underlying our mountains of solid waste is massive consumption of materials in the United States, according to Arsen J. Darnay Jr., director of the Resource Recovery Division of EPA's Office of Solid Waste Management Programs.

"Our materials consumption is the highest in the world," Mr. Darnay points out. "It amounts to 28 tons per person annually, and is growing at a rate of 4 per cent per year. Ultimately, for a number of reasons, we will simply have to cut back on consumption."

Over a period of time, whatever is consumed becomes waste. That means that an American family of five accounts for *280,000 pounds* of waste in various forms every year. Not all of it turns up in municipal garbage cans, of course. Much of it accumulates at mine mouths, on farmer's fields, and in the waste hoppers of factories, stores, processing plants and other businesses. But city trash collectors get a burdensome share.

Even before an eventual national consumption cutback, Mr. Darnay says, "Recovery of resources from wastes will become more and more necessary. It is a vital measure to prevent pollution, to conserve our natural resources, to lessen our reliance on imports, and to reduce the quantity of solid wastes that must be handled."

This is true not only in those cities already faced with towering walls of rubbish and no good place to put it, he adds, but also of many municipalities which until recent years had seemingly boundless areas available for dumps and landfills. Now, Mr. Darnay notes, few people will quietly tolerate such disposal areas near their homes or businesses. Cheap, convenient "close-in" sites in rapidly expanding urban areas are becoming scarce nationwide, and the cost of collecting and hauling—already 80 per cent of the total for getting rid of solid wastes—is increasingly prohibitive.

Baltimore is a case in point, with virtually no traditional-type disposal sites remaining within the city and two big incinerators striving without success to burn all the waste completely and within state pollution limits. Sanitary landfills have become just about that: filled. In fact, a golf course and part of a city park now occupy topped-off areas.

One incinerator is to be upgraded to modern standards at a cost of $6 million, but the other is beyond redemption. By 1972, relates Public Works Director F. Pierce Linaweaver, the situation presented "a combination of factors that appeared overwhelming. We found the technology of pyrolysis, as applied in the *Landgard* system, offered us the best solution."

EPA is embarked on a three-phase program to show communities like Baltimore how they can overcome such odds and meet their specific needs.

Since use of resources is ultimately responsible for waste, EPA is exploring federal policies that will make uses more efficient. Putting waste itself to worthwhile use is two ways better than just trying to hide it, and market opportunities are being sought for converted waste materials.

contaminate the paper so badly that it cannot be reused at all. Similarly, only limited amounts of a recycled material can be used in the production of some 'new' products. Because reclaimed rubber doesn't have the uniformity or abrasion resistance found in virgin or new synthetic rubber, new tires can contain only 5 to 12 percent of the recycled material."
Newsweek, May 21, 1973.

"Far more could be done, but simple economics still favor the use of 'virgin,' or fresh, raw materials over recycled products. Recycled glass costs as much as $23.77 a ton to produce vs. $18.43 for the original product; a ton of writing paper made from recycled waste costs $20 to $30 more than the same thing made from virgin pulp. Freight transportation rates also make it cheaper to use new metal ore or virgin timber than scrap metal or recycled paper. It costs $17.86, for example, to ship a ton of copper from a mine in Copperhill, Tenn., to a smelter in Laurel Hill, N.Y., vs. $22.60 for scrap. Virgin materials also benefit from tax breaks that give them a competitive advantage. Producers

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		of virgin paper are taxed at the rate of 28 percent vs. about 43 percent for paper recyclers. The cost of collecting or separating used materials also hampers recycling efforts. For example, each ton of municipal refuse contains an estimated $12 in copper, lead, tin and zinc. But most of these materials must be separated by hand and, unless the work is done by volunteers, labor can cost four times as much as the recycled products are worth." Newsweek, May 21, 1973.
WHAT IS THE ENERGY CRISIS?		
. "Energy is the fuel of life. Even the human body consumes energy. The 2,000 or more calories of energy you take into your body each day---sustain your life." Man Builds-Man Destroys, University of the State of New York, State Education Department, Albany, N.Y. 12224	. Discuss the following quotation from "Man Builds-Man Destroys": "'Between this earliest stage and the dawn of recorded history,' writes M. King Hubbert, '(man) distinguished itself from all others in its inventiveness of means for the conquest of a larger and larger fraction of the available energy. The invention of clothing, the use of weapons, the control of fire, the domestication of animals and plants, all had this in common: each increased the fraction	. "Oil, now the main source of industrial energy, is being consumed at a much faster pace than new deposits are being discovered. Its lifetime could be just another century more or less. Coal will last a few centuries longer, but most of it is high sulfur content, causing severe air pollution. Strip mining, by which 44 percent of the coal in the United States now is extracted, exerts a devastating impact upon land. The potential for hydroelectric power is substantial in undeveloped areas of South America,
. "Today, the average American still uses 2,000 calories or so of food energy as did his prehistoric forebears; but today that intake comprises only 1 percent of the average American's energy budget. The		

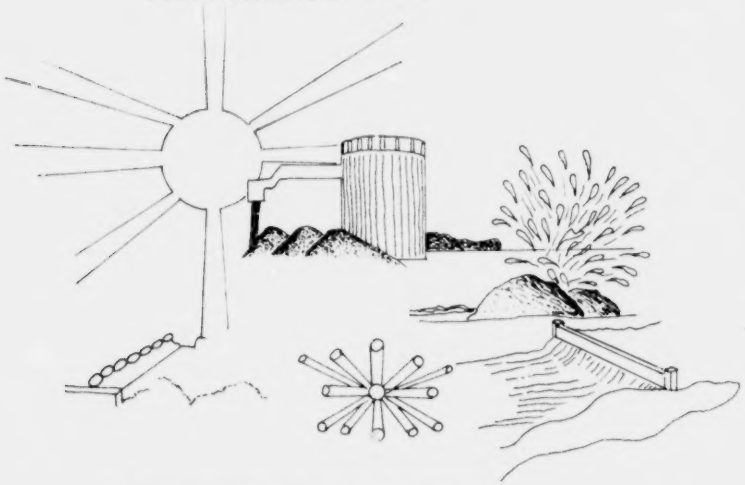
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
other 99 percent powers his generators, automobiles, airplanes, factories, communications networks. Civilized man has grown up to be almost as dependent on this total energy budget as were his predecessors on their modest allotment. In fact, modern man's energy needs are doubling every 10 years, and he must continually seek new sources." Ibid.	of solar energy available for use by the human species, thereby upsetting the ecologic balance in favor of an increased population of the human species, forcing adjustments of all other populations of the complex of which the human species was a member.'" . Will our energy resources of oil, coal, hydroelectric power, solar and tidal energy be sufficient to meet our needs? . Ask pupils what potential pupils feel the power of the tides might have. One authority has stated that where they can be utilized they are a small, but useful, potential addition (all the tides of the U. S. would only supply electrical needs of Boston).	Africa, and Southeast Asia, but most dam sites already have been exploited in Western Europe and North America. Geothermal power is another possibility, but is limited to the availability of underground steam and does not appear to be the answer to the world's energy needs. Ocean tides contain enormous power, but there appear to be few suitable places where the energy can be harnessed. The sun, of course, is the ultimate source of all our energy except nuclear, but so far our technological concepts are not equal to capturing this power directly and converting it to our uses, at least in a practical, satisfactory way." "Man Builds—Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224
IS THERE REALLY AN ENERGY CRISIS?		
. While opinions differ, the preponderance of opinion is that there is a real shortage of energy.	. Ask pupils for their opinions as to whether there is an energy crisis. What experiences have they had on which to base opinions? . Have they faced - difficulty in buying gasoline? - a black-out or reduction in voltage? - difficulty in obtaining fuel oil or gas?	. Some evidences of an energy shortage - closing of gasoline stations; - limitations on amount of gasoline sold; - refusal of gas service to new home owners or commercial enterprises; - voltage reductions during periods of peak use.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	- have they or their parents noted a shortage or reduction of power in their places of employment?	
WHY HAS THE SHORTAGE DEVELOPED?		
. There are many reasons, including national policies, increased consumer use, environmentalists actions, poor planning.	. Collect clippings, articles, and reports on the energy crisis. Discuss the question of what should be done, if anything, to improve the situation. . Conduct a debate on the subject Resolved: the environmentalists are too restrictive and hinder the development of new energy sources to the harm of business and the consumer.	. Power consumption has increased by 100 percent in the last two decades. . Demand for electricity has doubled in 10 years. . Delays in construction have been frequent. . Conservationists have tied up in court projects for new power supplies. . Certain fuels have been banned because they add to pollution. . Exploration and discovery have been inhibited by tax policies.
WHAT SHOULD BE DONE ABOUT THE ENERGY CRISIS?		
	. Have pupils research the problems of resolving the energy crisis. Tabulate in chart form the steps that might be taken and ask the class to vote on those which are acceptable.	. "This 'Energy Crisis' — Is It Real? Changing Times, October 1972.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
ASIDE FROM FOOD, WHAT TYPES OF ENERGY ARE AVAILABLE?		
. Oil is now the main source of industrial energy. . Coal is a second major source of energy. . Hydroelectric power is another source. . Geothermal power from underground steam is limited in availability and thus has limited potential. . Ocean tides have the potential of great power but are difficult to harness. Other potential power sources are - nuclear - natural methane gasses - ocean temperature gradient changes - wind	. Have pupils list the major sources of energy. What percent of the total supply would they estimate comes from each source? Then compare their estimates with those of the Petroleum Industry given in the Source column.	. "At present, petroleum accounts for 77 percent of our total energy consumption. Coal accounts for 19 percent, and hydropower for less than 4 percent. Nuclear power, already commercially feasible, is expected to grow from its present share of less than half of one percent to more than 17 percent in 1985. "Other, more exotic sources such as geothermal power, synthetic fuels, ocean power, and solar power ultimately may become vital supplements as technology for their utilization improves." Petroleum Today, 1972/two, American Petroleum Industry, 1801 K Street, N.W., Washington, D.C. 20006 . "Water power is one of the oldest forms of energy used by man. But hydroelectric generation dates back only 90 years to the early 1880's when a small plant was installed at Appleton, Wisconsin. "The great dam-building activity of the 1920's and 1930's capitalized on many of the obviously suitable sites. A number of potential sites still remain to be

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE

MAN'S SOURCES OF ENERGY



man obtains energy from water, coal, oil, thermal (sun) power, geothermal (steam), tidal, and nuclear sources.

developed, but most are in the western portion of the U.S., while the current energy shortage is most acute in the eastern half of the country. And some conservation groups have objected to the development of these proposed sites.

"Despite its advantages, hydroelectric power generation seems to have reached a plateau. As electric power production increases from all sources, hydroelectric power is expected to provide a smaller and smaller percentage. In 1970, hydro plants accounted for 4 per cent of total United States energy supply. By 1985, they are expected to provide only 2.5 per cent—a small but important share."

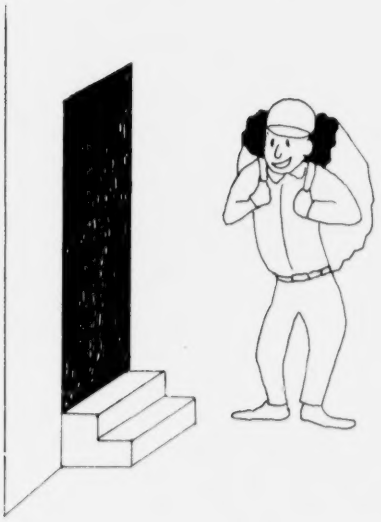
Ibid.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Ask pupils who have observed geysers such as Old Faithful to describe what they have seen. What might be some of the difficulties of utilizing this source of energy?	. "What is geothermal energy? Heat radiates constantly from the earth's core, sometimes concentrating in local hot spots near the surface. When underground water meets naturaliy heated underground rocks, steam results—the same kind of steam that makes Old Faithful perform on schedule. By drilling into geothermally active areas, natural steam can be directed into the blades of turbines to produce low-cost electricity. "Scientists estimate that in the U.S. about 1.8 million acres of land are attractive for geothermal development, and that the potential geothermal capacity ranges from 30 million to as much as 100 million kilowatts. By comparison, our present installed electric generating capacity from all sources is about 367 million kilowatts." Ibid.
	. Ask pupils who have observed tidal action to describe what they have seen. How could such forces be harnessed to provide power for industry?	. "So far only one plant (for harnessing tidal energy) has been built, a $100 million facility in Brittany which furnishes 500,000 Kilowatts of electricity to France." Ibid.

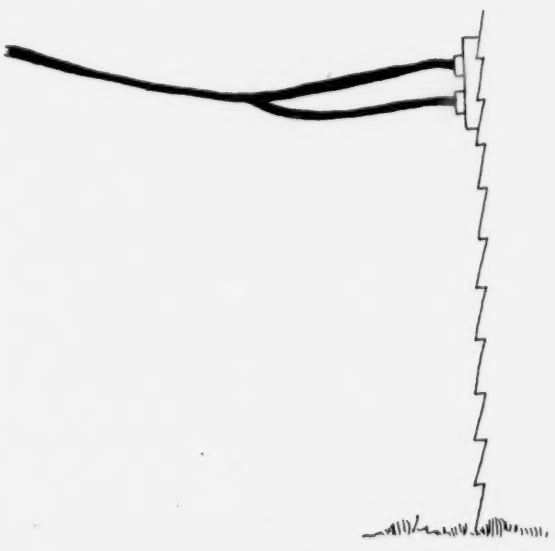
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
. Solar energy, energy from the sun, has potential for greater development; but scientists differ on the question as to how important a part it will play in the future.	. Have students research the use of solar energy and its potential for the future. Solar water heaters were once big business in parts of the United States. Why has their use fallen off? cost? service? availability of other more efficient sources? problems of climate?	. "Power From Sun: The Search Picks Up," U.S. News & World Report, April 16, 1973 . "A Solar Energy Panel of top federal scientists has concluded that, with increased research and development, this timetable is possible: "In five years, solar energy could be heating many private homes and office buildings. "In less than 10 years, the sun's power could be running air-conditioning systems. "In five to 10 years, solar heat could be used to convert organic materials into fuel oil and methane gas. The latter is similar to natural gas and can be employed for the same uses. Experts say that this process is capable of providing the U.S. with a third of its gaseous fuels by shortly after the turn of the century. "Within 15 years, the sun's energy could be producing substantial amounts of electricity for American consumers." Ibid.
. In the economic considerations two points should be remembered 1. The cost of obtaining fuel and processing it; 2. Increased dependance on foreign nations for fuel supply.	. Write to the National Science Foundation for the report of the Solar Energy Panel. Comment on the conclusion reached by this panel. "The Solar Energy Panel is made up of experts from the National Science Foundation and the National Aeronautics and Space Administration. It sums up the future in these terms: "There are no technical barriers to wide application of solar energy to meet U.S. needs ... For most applications, the cost of converting solar energy to useful forms of energy is now higher than conventional sources, but [with] increasing constraints on their use, it will become competitive in the near future." "Power From Sun: The Search Picks Up," U.S. News & World Report, April 16, 1973	

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
WHAT RESOURCES OF COAL DO WE HAVE?		
. Our supply of coal is one of our richest sources of energy.	. What are the problems in using coal as an energy source? In addition to the economic problems, what should be done about the environmental problems of smoke, fumes, ash, the effects of strip mining? Who should pay the research costs for improving technology? . Ask pupils who have seen the effects of strip mining of coal in Pennsylvania or West Virginia to describe what they saw. . Report on attempts to reclaim the land where strip mining has taken place. (See research done by Penn State University)	. "America is sitting on a vast storehouse of coal—a supply sufficient for some 650 years by best estimates. But much of this fuel cannot be used under new air-pollution laws because it is so high in sulphur content. At the same time, natural gas, which supplies one third of all energy requirements in the U.S., is being consumed faster than new reserves can be located. Production from U.S. wells is expected to peak in about eight years and then start to decline. If the advanced technology were available, clean-burning methane gas could be produced from coal and a long step would have been taken toward supplying the nation's fast-growing energy needs." "Gas From Coal: For Cleaner Air," U.S. News & World Report, January 22, 1973 . "Coal gasification—the production of methane gas from coal—has been under way in Europe for more than three decades, but the process is expensive and the product of low quality when compared to natural gas. "Experts say it will be at least five years

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Specialists in the New York State Department of Environmental Conservation in reply to the quotation in the source column state that - there are cheaper ways of producing clean fuel; - traditionally pollution control systems have been designed to handle pollutants in such a way that the systems are liabilities. Little effort is made to make these pollutants pay; - they inquire as to how long industries will continue to be isolationists? Do pupils agree with their point of view or that expressed by U.S. News and World Report?	before coal gasification becomes a successful commercial process in America. These questions are yet to be answered: Can one process be developed which will work for all types of coal? Which of the many theoretical models will produce the best gas, for the least amount of money, in the shortest time? "Until industry has firm answers to these questions, companies are reluctant to invest the 250 million dollars needed to build a single commercial-size plant. This year the Government is spending about 30 million dollars on gasification research, and industry is contributing another 10 million dollars." Ibid.
HOW DEPENDENT ARE WE ON COAL AS AN ENERGY SOURCE?		
. Experts agree that we have coal resources which should last for 600 years or more.	. Ask pupils what they think is the power source for most electricity that is generated. (In 1970, more than one-fourth of our electricity was derived from surface-mined coal.)	. "Many Americans do not realize how heavily they depend on coal for electricity. Yet the fact is, when they turn on their dishwashers or switch on their televisions to catch the evening news, the chances are about fifty-fifty that they will be using electricity generated from coal. "It follows then that when coal supplies are

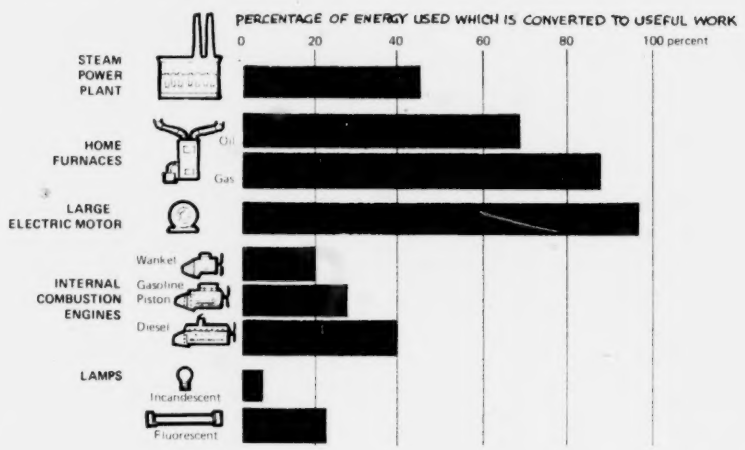
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Since our coal reserves should be ample to supply our needs for many years from this source of energy, what is the problem? (Ask the science teacher to discuss the problems of using high sulphur coal. What progress is being made in reducing pollution from the source? What are the possibilities of converting coal into gas? What are the advantages in the use of gas instead of coal? What problems result from strip-mining?) . Ask pupils who live or whose parents lived near coal burning furnaces to describe the effects of the fumes on silverware, draperies, and house paint.	cut off, many electric utilities are in deep trouble for fuel." Petroleum Today, 1972/ two, American Petroleum Industry, 1801 K Street, N.W., Washington, D.C. 20006. . "Bruce Mansfield, president of Ohio Edison Co., has predicted that if Ohio's new air pollution standards are strictly enforced, that state will experience a blackout that could make the New York outage seem minor by comparison. Other areas, too, including many major cities, are seeking alternate fuel sources as government restrictions force them to abandon coal. Some utilities, to their dismay, are finding it extremely difficult to obtain fuel that will meet the rigid air quality requirements now facing them. "The United States does not suffer from a shortage of coal. It is, in fact, our most abundant domestic fuel resource, with more than 390 billion tons in reserve—enough to last more than 600 years at present production rates. What we do suffer from are restrictions that rule out the use of much of the coal we have readily available." Ibid.

Energy comes in many forms: in bags, bottles, and through wires



UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Survey your community to see what industry has done to cut down on the pollution from the use of high-sulphur fuels. How much money did industry spend to make the change? What observable effects have been noted? What still needs to be done?	. "One prospect of using high sulfur coal—the kind most affected by clean air regulations—lies in removing sulfur dioxide from stack gases after coal is burned. Some 20 processes are being developed, and some are undergoing large-scale tests, but none is yet fully proved and commercially available. "The most promising innovation for coal's future is converting it into gas. Four pilot plants are already under construction, and experts predict that gas will be produced commercially from coal by the 1980's." Ibid.
	. Have pupils check to see whether the statement in the Source Column regarding no process available for removing sulphur dioxide from starch gases is still true.	. "In addition to gasification, scientists are researching other coal projects. One concept is the combined cycle in which coal is gasified and burned in a gas turbine; the hot exhaust gases then generate steam to turn a second turbine. Its virtue is a relatively high efficiency rating and low capital costs. Another project is the coal fuel cell which has a potential conversion efficiency of 60 to 70 percent. "At one pilot plant, the possibility of producing crude oil from coal is being

How much energy is lost



How much energy is lost

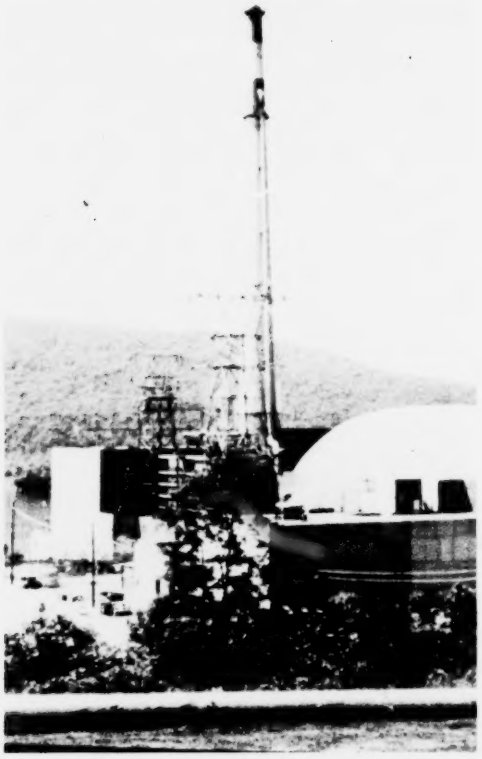
Environmental Plan for New York State, New York State Department of Environmental Conservation

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		explored. Another plant will soon produce solvent-refined coal, which is free of ash and sulfur, has a low melting point and can be handled as either a liquid or a solid. On a longer-range level, researchers are developing a magneto-hydrodynamic (MHD) generator which would allow for a 30 to 40 per cent increase in efficiency compared with the most modern steam plant." Ibid.
. Environmental problems plague the use of coal as an energy producer.	. Discuss the problems posed by the use of coal as an energy source. How would any restriction on coal usage affect the consumer? . What price tag should be put on the health of people?	. "To cut back on surface mining could worsen the energy shortage in the United States. In 1970, for instance, more than one-fourth of our electrical energy was derived from surface-mined coal. Strip mining will also help supply the vast quantities of coal which will be needed for a full-blown gasification program. "Our real hope for domestic supplies of clean, reasonably-priced fuels lies with coal in its new gaseous and liquid forms. But if coal is to supply synthetic fuels in the future, the industry must be allowed to mine it and the utilities to burn it in its current solid form." Ibid.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		. "Any realistic energy policy must take coal into consideration. For to overlook coal or to skimp on the research effort needed to solve its environmental problems would waste a valuable resource which can provide us with an energy mainstay for centuries to come." Ibid.
WHAT ARE THE POSSIBILITIES AND THE PROBLEMS OF NUCLEAR ENERGY?		
. "In some ways, a nuclear plant is similar to a conventional fossil fuel plant. Each uses steam to drive a turbine generator that produces electricity. The difference between nuclear and conventional plants is the fuel that heats water to make steam. While conventional plants burn coal, oil, or natural gas for fuel, a nuclear plant uses the heat generated by nuclear fission. To release each watt of energy, more than 30 billion fissions (splitting of the nuclei of atoms) must occur each second. The nuclear reactor provides an environment in which fission can be initiated, sustained, and controlled." Petroleum Today, 1972/ two, American Petroleum Industry, 1801 K Street, N.W., Washington, D.C. 20006	. Explore student attitudes toward nuclear power. What have they learned concerning its potential for power? What have they learned about possible harmful effects? Is there air pollution? Is there a hazard from radiation? Is there a possibility of uncontrolled, runaway reaction? What is the problem of thermal pollution?	. "At present, the atom supplies only about one percent of the world's power, but by the year 2000, as much as half of the world's power may come from nuclear energy. Most nuclear plant reactors today use uranium-235, which is in short supply, but with second generation breeder reactors, nuclear fuel would be plentiful for thousands of years. "Nuclear plants do not emit air pollution, but they do give off radiation. A former New York City Environmental Protection administrator and now a professor of environmental medicine, Merril Eisenbud, says that people living in the vicinity of a nuclear plant probably would be exposed to less radiation in a year

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		than passengers on one airplane flight from New York to Chicago." "Man Builds—Man Destroys," University of the State of New York, State Education Department, Albany, N.Y. 12224
	. To what extent do conventional fossil fuel plants burning oil or coal also contribute to thermal pollution?	. "Another major environmental problem with atomic power plants is waste heat, thermal pollution. The nuclear plant heats water to make steam to turn turbines to drive generators to produce electricity. The spent steam must be cooled and condensed back to water for reuse in the plant's closed system...and water from an adjacent river, lake, bay is required for this job." Ibid.
	. Invite the science teacher or knowledgable scientists in the community to discuss these problems and possible solutions. What would be the reaction of students toward the building of a nuclear power plant in the area where they live?	. "A recent tally shows that 26 nuclear plants now operate in the United States, 51 are under construction, and 61 are on order. The present generating capacity of nuclear plants is more than 10 million kilowatts, or some three percent of the total U.S. generating capacity. By 1980, nuclear capacity probably will reach 140 million kilowatts—21 percent of the national total—soaring to an estimated 475 million kilowatts by 1990, representing

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		about 38 percent of the total capacity projected for that year." Petroleum Today, 1972/ two, American Petroleum Industry, 1801 K Street, N.W., Washington, D.C. 20006.



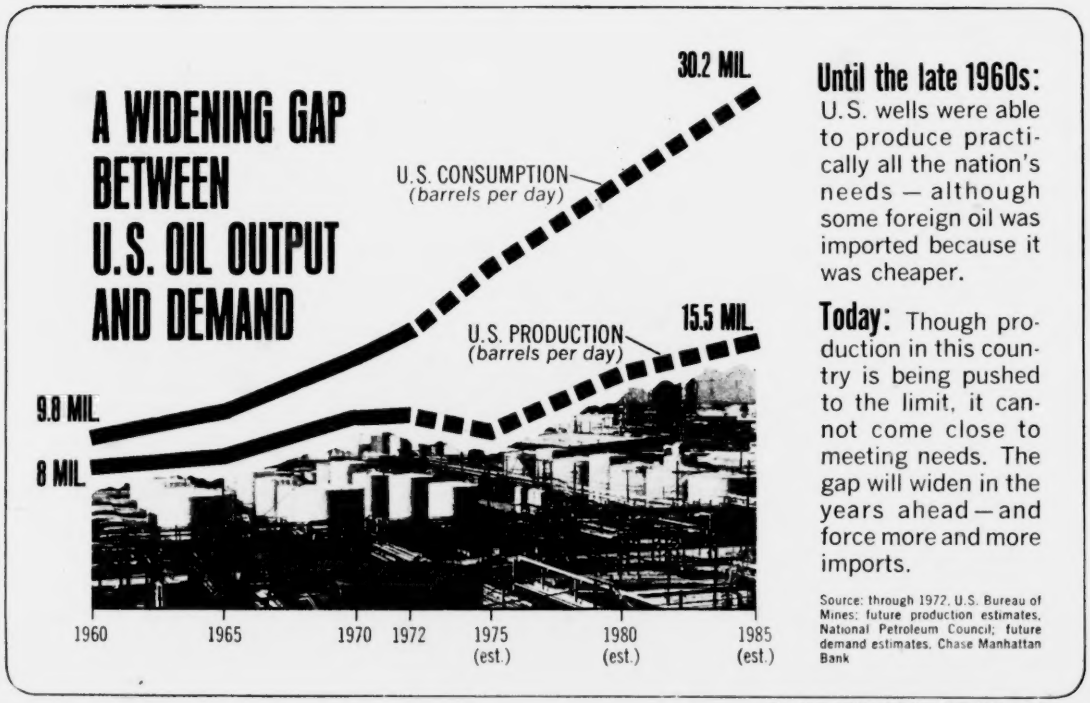
Consolidated Edison nuclear power plant on Hudson River

Photo courtesy of New York State Environmental Conservation Department

WHAT ARE THE IMPLICATIONS OF THE ENERGY SHORTAGE FOR CONSUMERS?

. While experts disagree as to the length of time our energy resources might last, there is general agreement that: - oil reserves in the United States will probably be exhausted within the next 100 years; - coal reserves will be exhausted within the next 600 years;	. The consumer is faced with the problem of conflicting values. All of us want unrestricted use of our automobiles, adequate fuel for cars, for home heating needs, energy to run our refrigerators, vacuum cleaners, TV's, power tools, radios, ranges, space heaters, and other mechanical devices.	. "Energy costs are bound to rise. We have exhausted a large share of our cheapest and most accessible energy materials. New indigenous supplies will come at higher prices. Coal mines will be further underground; oil and gas wells will be drilled to greater depths and in deeper waters offshore; the

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
- gas reserves are rapidly being depleted; - increasing amounts of foreign oil will need to be imported; - a major effort to expand outputs of nuclear power will be needed; - the nation's requirements for energy will about double between now and 1985. . These forecasts are based on present rate of consumption of energy — which is not the most efficient use. - Energy can be conserved by: - recycling of scrap materials; - better design of buildings; - conservation practices.	. With our requirements for energy doubling in less than 30 years, and yet with pollution from energy production increasing, how do we balance these conflicting elements?	development of oil shale and other synthetics will require expensive new technology. "At present the composite wellhead or minemouth cost of energy produced in the United States is about 35 cents per million BTU's. By 1985, it could easily be 50% to 100% higher. "These increases are significant, but they can be absorbed in our economy without serious disruptive effects. For the past decade, the real cost of energy in the United States has been declining. Today, we spend only about 5% of our national income for fuels. We are in a favorable position vis-a-vis the other world powers with respect to basic energy costs and will probably continue to be so even after the increases I have suggested. Our most urgent problem is one of adequacy and continuity of energy supplies—not one of energy costs." John G. McLean, Chairman, National Petroleum Council's Committee on the U.S. Energy Outlook.
	. There is increasing clamor against industry for destroying the environment by strip mining, pollution from	. "Natural gas is scarce. Shortages already confronting us will increase. Domestic production is projected


A WIDENING GAP BETWEEN U.S. OIL OUTPUT AND DEMAND
30.2 MIL
U.S. CONSUMPTION
(barrels per day)
15.5 MIL
U.S. PRODUCTION
(barrels per day)
9.8 MIL
8 MIL
1960
1965
1970
1972
1975 (est.)
1980 (est.)
1985 (est.)
Until the late 1960s: U.S. wells were able to produce practically all the nation's needs — although some foreign oil was imported because it was cheaper.
Today: Though production in this country is being pushed to the limit, it cannot come close to meeting needs. The gap will widen in the years ahead — and force more and more imports.
Source: through 1972, U.S. Bureau of Mines; future production estimates, National Petroleum Council; future demand estimates, Chase Manhattan Bank

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U. S. NEWS & WORLD REPORT, April 30, 1973

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UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	refineries, constructing nuclear power plants, pollution of land and waters from the products of technology, destruction of our forests and natural park areas. Yet each year our demand for industrial products increases. To what extent are consumers willing to forego the conveniences they have come to expect? Will there have to be compromises between the needs of industry and the environmentalists? To what extent are industries willing to change designs and processes to make more durable products and products that can be recycled more easily? To what extent are industries willing to forego expensive advertising of products and use the money for improving products? (Used oil refining is a good example of one way resources could be conserved.)	to decline about 1/3 during the next 15 years. With more imports of natural and liquefied gas and synthetic gas from naphtha and coal, we may hold gas availability at about its present level. This will be sufficient to satisfy less than half of our potential gas requirements by 1985." Ibid. . "Crude oil imports will have to quadruple. Domestic production of crude oil is projected to show little net change. To meet rising demand, imports will about quadruple, reaching 10 to 15 million barrels a day in 1985. Even larger imports will be needed if we fail to meet our goals with respect to nuclear power and coal." Ibid. . "We shall have to launch a major new effort to expand our outputs of nuclear power and coal. We should seek to construct the equivalent of at least 280 nuclear energy plants of 1,000 megawatts each during the next 15 years. Today, we have the equivalent of only ten plants of such size in operation and only 46 actually under construction. Progress

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		is being retarded by technical difficulties and environmental restraints on the selection of new plant sites." John G. McLean, Chairman, National Petroleum Council's Committee on the U.S. Energy Outlook, "U.S. Energy Outlook and Its Implications for National Policy", September 21, 1972.
	. What will be the political and economic effects of our dependence upon oil from the Middle East? . With "energy" stocks so depressed in price, where will the investment money to expand resources come from? . With "balance of payments" so out of balance that our dollar is being weakened, what will be the effect of further dependence on the Middle East for oil and consequent larger and larger deficits in the balance of payments?	. "The nation's requirements for energy will about double between now and 1985. In this period, we shall have to rely upon oil, gas, coal, and nuclear power for at least 95% of our needs. If present trends continue, our indigenous resources of these materials will not be developed fast enough to meet our growing requirements." John G. McLean, Chairman, National Petroleum Council's Committee on U. S. Energy Outlook. . "We shall become increasingly dependent upon foreign countries, primarily in the Middle East, for a vital portion of our energy supplies. At the present time, we obtain about 26% of our crude oil and 12% of our total energy requirements from foreign sources. By 1975, we will probably draw about 40% to 55% of
WHAT CAN CONSUMERS DO TO IMPROVE THE SITUATION?	. Consider the suggestions listed by Joseph Kraft as reported in the Albany Times Union shown on the following page. . Contrast these views with those of the Petroleum Council in the Source column.	

"How to Beat the Energy Crisis," by Joseph Kraft

The selfsame seers who brought you the missile gap, the domino theory and the Maoist menace have now picked up the energy crisis. To hear them tell it, industry will halt, the highways will be black with gasless cars, and millions will freeze in the dark, unless America asserts itself against those supposed villains of the piece, the Arabs and environmentalists.

But in fact there are dozens of much more acceptable ways (some of them almost as virtuous as motherhood) for this country to ease the growing gap between energy consumption and energy production. Here is a checklist of possibilities which should provide some measure of the national energy policy the Nixon administration is slowly bringing to birth.

CONSERVATION OF energy heads the list. The United States, with 6 per cent of the world's population, consumes about 30 per cent of its energy. We consume, person for person, more twice the amount used in such a heavily industrialized area as Western Europe.

Much of the energy consumed is wasted in automobiles carrying only the driver. Enormous savings in energy could be achieved by moving commuters in buses or other forms of mass transit. Decent inter-city railroads would cause many people to leave their cars at home and travel by train. A tiny effort could probably induce 2 or 3 per cent of the population to move around by bicycle; and that tiny saving would at least cover the gasoline shortage predicted for this summer.

Housing offers only slightly less abundant opportunities for husbanding energy. A considerable part of this country's energy consumption goes for private homes with poor insulation. It would be child's play for federal authorities to insist that good insulation be a condition for getting mortgage money on which virtually all home-building depends.

Next to conservation of energy, the best results would appear to spring from a research and development program. At present the United States Government spends only about $700,000 on energy research—most of it in the atomic-power field. Private industry spends an estimated $300 million. Since the power industry grosses something like $60 billion annually, the total research input is trivial. Especially in view of the likely pay-off.

NUCLEAR POWER does offer tremendous possibilities for the distrant future if the technical problems of waste disposal and safe operation can be solved. Geothermal energy and solar energy may be equally bounitful sources for the future.

In the meantime, there are abundant supplies of coal, shale and tar in this country, Canada and Latin America. Tremendous dividends would be yielded by a research program for cheap and clean devices to transmute those deposits to oil and gas.

Even before that, research can make large savings in fuel consumption by that worst of all wasters — the private car. With phased federal standards that stipulated not only emission control but also energy control, Detroit might begin to turn its energies to producing a cleaner and smaller engine, rather than concentrating, as now, in bucking the application of standards.

Pricing strategy offers still another way to meet the energy crisis. By which I don't mean socking small homeowners. I mean adjusting prices to industrial users. They gobble up about 40 per cent of the energy consumed in this country, and if prices were stiffer, they would turn off the lights occasionally.

Finally, important savings for the American consumer can probably be achieved by a new technique for buying oil abroad. At present the price is driven up by American firms competing against Japanese and West European firms. By organizing with the governments of Japan and Western Europe a consumers' consortium against the producers' cartel, this country could get far better terms than the oil companies who really care hardly at all about the consumer.

WHAT ALL THIS says is that the United States can afford to be careful and picky about meeting the energy shortage. Nobody has to worry about having an Arab in his tank instead of a tiger. If things do go wrong, if gas shortages develop, don't blame the Wildlife Foundation. Blame the responsible figures in the companies which have for so long been acting improvidently and the administration which has, for so long, been doing nothing

Albany Times-Union,
March 19, 1973

SOURCE

our oil and 23% to 32% of our total energy from abroad.
"Dependence upon a small number of distant foreign countries for a vital portion of our energy supplies will be a new fact of life in the history of this nation. We shall need to take a new look at our foreign policies with respect to the Middle East and attach to them a much higher priority than they have thus far been accorded."
Ibid.

"Growing oil and gas imports will provoke a large, growing deficit in the U.S. balance of trade in fuels. By the early 1980's, this deficit could be in the $20 to $30 billion range, compared to a current deficit of less than $3 billion. Today, our total exports of goods and services are only about $66 billion. To pay for our imports of fuel, we will need to seek additional exports of other goods and services."
Ibid.

"Enormous capital inputs will be necessary to provide for our energy requirements. Between now and 1985, the United States energy industries will have to invest between $400 and $500 billion in new productive and distribution facilities, an

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE

the energy crisis

Progress *is* being made to ease the expected energy famine, but it's slow and costly.

What else can we do? What can we do *now*?

▷ First, accept the fact that the problem is real, and now upon us.

▷ We must change our thinking. We can no longer think of using energy as if it flowed freely from a bottomless spring.

▷ Instead of driving the family car three blocks to the market—walk the distance, or bicycle.

▷ If your vacation this year involves driving the family car, head for a resort near your home. San Diego residents should avoid that motor trip to Maine if they can. By all means, keep your engine tuned.

▷ Support establishment of rapid transit systems in your area, and join a car pool until plans for moving large numbers of people at a low output of energy become operational.

▷ Write your senator and representative in Congress urging them to initiate and support legislation to appropriate funds for development of programs to convert coal to low-sulphur gas and oil, to open shale oil lands and explore other sources of fuel.

▷ Hoard your own household energy... turn down the heat at night... click off unused lights... use air conditioning only when necessary... don't preheat your oven too long... open the drapes during the day to let in solar heat. In simple terms, be a "power skinflint."

These are just some of the steps we can take now... before it's too late.

A few years ago when we were shooting for the moon, we never dreamed the lights would go out at home... or that the corner service station would ever run dry.

But it's happened.

We've slipped up somewhere along the way. ■

©Occidental Petroleum Corporation 1973

annual average of about $30 billion, compared to present outlays of about $16 billion."
Ibid.

. "We should take prompt action to establish a single, high-level agency in our government to develop a national energy policy and to coordinate our efforts relating to energy matters. I do not mean that our Federal government should play a larger role in the discovery and development of natural resources. This task should be left to private enterprise. The chief mission of the central government agency should be to establish priorities and guidelines and to eliminate delays, conflicts, and confusion."
Ibid.

. "We should reduce waste in the consumption of energy. I am not suggesting curtailments which would have a negative impact on the growth of our economy. On the contrary, I believe the consumption of energy should be encouraged because it increases the efficiency of our economy—providing that the energy is used for socially desirable ends."
Ibid.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	. Ask the science teacher to explain how energy could be conserved through the steps suggested by John McLean as quoted in the Source column. What is meant by "the development of more efficient conversion systems?"	. "There are many areas in which we could conserve energy without impairing economic growth. For example, 20% of our energy is used for commercial and residential heating; savings can be made through better insulation. About 25% of our energy is used for transportation; savings can be made through the development of mass transportation and smaller and more efficient automotive engines. Another 25% of our energy is used for the generation of electric power in processes which waste about 70% of the energy input; savings can be made through the development of more efficient conversion systems." Ibid.
	. Contrast these views with those expressed in "The Potential of Energy Conservation," Office of Emergency Preparedness, Washington, D. C.	
WHAT IS BUSINESS DOING TO CONSERVE ENERGY?		
. Industry is moving to save both money and energy.	. Make a survey of your own business community to see what business is doing, and plans to do, to conserve energy.	. U.S. Steel uses the natural gas driven off by its coke ovens for fuel in other operations.
	. Ask your municipal authorities what if anything they could do.	. United Airlines planes taxi to airports, after landing, using two engines instead of four. The company has asked for permission to reduce speed on its transcontinental flights from 588 mph. to 547 mph., thereby saving 350 gallons of fuel per flight.
	. Make a list of suggestions from class members and forward them to the appropriate agencies for comment.	

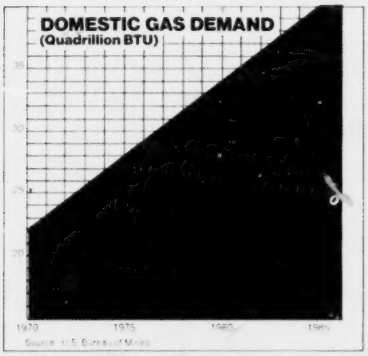
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		. Chrysler Corporation is concentrating on a program to reduce the weight of cars and thus save on fuel consumptions. . Dow Chemical has reduced its energy use 15 percent. . Lockhead-California saved million on its power consumption by raising air-conditioner settings.
WHAT CAN CONSUMERS DO TO SAVE ENERGY?		
. Each of us as a consumer can help.	. Make a list of ways in which energy could be conserved by consumers. The list might include such items as the following: - buy cars that are lighter and more economical on gasoline; - turn off lights when not needed; - turn down the heating thermostat at night and a few degrees during the day; - set the thermostat turning on air conditioning at 75 degrees instead of 70 or 72; - buy refrigerators with no defrosters or automatic defrosters instead of the frost free type which use one-third more electricity.	. "Save a Watt," Newsweek, 5/28/73. . Secure a copy of the brochure of 65 tips on energy saving from Montgomery Ward & Co., Chicago, Illinois. . Ask your local public utility for suggestions on energy saving tips.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	- open refrigerator doors as seldom as possible; - match pots and pans to range burner size to prevent escape of heat.	
ARE THE PROBLEMS OF ENERGY INTERRELATED?		
. Yes. Each shortage of energy producing products has its relationship to other products and to national policy.	. Have pupils research the energy crisis literature to discover the causes of the present shortage and how each element fits into the total picture. Note that - there is not enough refining capacity in this country to meet the demand for petroleum products; - gasoline consumption is rising faster than anyone anticipated; - pollution control devices and power take-off devices such as air conditioning require more gasoline to be consumed; - oil companies have not built needed refineries because of environmental and financial constraints;	
WHY DO NOT OIL COMPANIES BUILD THE NECESSARY REFINERIES TO PRODUCE NEEDED PETROLEUM PRODUCTS?	- legislation and litigation have made it difficult for refineries to obtain necessary new sites; - the oil companies claim that the wholesale price of gasoline and heating	. To build a refinery costs about $250 million. . An average of about four or five refineries should be built each year for the next seven years to meet increasing demands.

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
	oil are insufficient to cover the increased cost of building refineries.	. No new refineries are presently under construction. . It would take about three years to complete a 160,000 barrel-a-day refinery.
HOW CAN THE SUPPLY OF NEEDED PETROLEUM PRODUCTS BE INCREASED? . Building new refineries would help . The petroleum industry could collect and process billions of gallons of used oil. . The possibilities of economizing through the use of central heating and air conditioning systems that would supply a whole city or a block of homes instead of many individual systems should be explored.	. What other problems beside additional refineries are there? . How has the environmental problem limited the development of Alaska oil resources and off-shore resources? What action of Congress is needed to permit the building of the Alaska pipe line? (Environmental restrictions on the width of the right-of-way of the pipe line must be changed.) . Why can't additional supplies of oil be provided from abroad?	. "The 'lower 48' states are the most heavily explored region in the world, and we're using more oil than we can find here. Almost all of the older fields are now at maximum production, with the industry producing every barrel it can. And for environmental and other reasons, oil companies haven't been able to obtain access to oil discovered on the North Slope of Alaska or to the unexplored areas of the East and West Coasts." Mobil Oil Company, 150 East 42nd Street, New York, New York, 10017 . "Some gasoline is being imported. But supplies overseas are very tight, because of high demand and tight crude oil supplies. The U.S. has to compete with other countries for these tight supplies." Ibid.

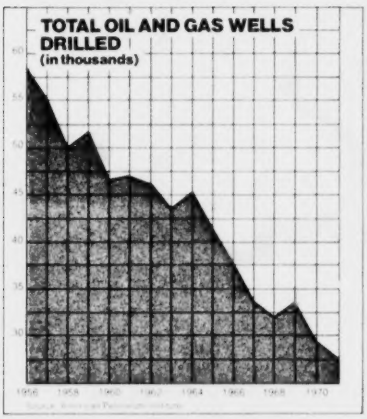
UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE
		. "Supplies are tight everywhere. Most overseas producing areas are at maximum producing levels, and some major producing countries have actually curtailed crude oil production." Ibid.
COULD GASOLINE BE USED MORE EFFICIENTLY? IF SO WOULD THIS SOLVE THE PROBLEM?		
. It would help, but probably would not solve the problem.	. Have the class explore and discuss ways in which gasoline could be used more efficiently. (Keeping engines at top operating efficiency, improving driving patterns, using mass transportation instead of private cars, using engines that consume less gasoline.)	. Many experts feel that even with better utilization of gasoline, consumption of gasoline will increase. . Darrell Trent, Director of the Office of Emergency Preparedness, Washington, D. C., suggests the following to avoid gasoline rationing: - use car pools; - keep cars "tuned up"; - reduce the use of air conditioning which increases gasoline consumption by 10 percent; - use smaller cars.
HOW ARE THE PROBLEMS OF GASOLINE CONSUMPTION AND OIL HEATING RELATED?		
. Refineries can produce either heating oils or gasoline, but production of one is at the expense of production of the other.	. Have the science teacher or other knowledgeable person discuss the refining process and show how either gasoline or heating oil may be obtained.	. "With gasoline consumption at record levels, the limited refining capacity and shortage of crude oil made it impossible to manufacture enough heating oil in this country this past season, so we had to import more. Heating oil consumption increased by record amounts, and so did domestic production of it. But refiners found themselves still maximizing production of heating oil at a

UNDERSTANDINGS	SUGGESTED PUPIL AND TEACHER ACTIVITIES	SOURCE



The demand for gas goes up and up.

Since 1956 gas consumption in the U.S. has almost tripled. Demand has been spurred by growth in population and industry. The low cost of gas has been another big factor. And the increasing concern with pollution has led many businesses to convert from other fuels to cleaner burning gas. More gas supplies *can* improve our environment.



The number of wells drilled has gone down.

While demand has been rising, exploration and drilling for gas has declined—because acreage in the Gulf of Mexico has not been offered for leasing on a regular basis, and primarily because prices at the wells have been regulated at artificially low levels. With the sharply increasing costs of drilling deeper wells and drilling further offshore, also the high odds of hitting nonproductive wells, plus rising costs of labor and materials, there is insufficient incentive for producers to risk money in the search for new supplies of gas.

time of year when they'd normally have started maximizing gasoline. Gasoline supplies are very low in relation to demand. Supplies of gasoline on April 1 of this year were at least a billion gallons lower than a year earlier, because of the continued pressure on refiners to maximize heating oil, at the expense of gasoline. And gasoline consumption is running much higher now than last year." Ibid.

Summary of Part I

In Part I, technology and its effects have been defined and explained. The benefits and detriments of technology have been discussed. The energy crisis and its continuing implications are dealt with. Our resources of coal have been considered and related to other energy resources.

In Part II, the companion volume, other sources of energy are considered including gasoline, heating oil, and natural gas. Implications for consumer consideration are raised. Suggestions of ways to cope with the problems of a technological age are discussed. Most important of all, considerations which involve life styles and values are raised to help young people make decisions.